



NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

TECHNICAL NOTE 4169

ATMOSPHERIC TEMPERATURE OBSERVATIONS TO 100,000 FEET
FOR SEVERAL CLIMATOLOGICAL REGIONS
OF THE NORTHERN HEMISPHERE

By H. B. Tolefson

Langley Aeronautical Laboratory
Langley Field, Va.



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SUMMARY

Radiosonde measurements of upper-air temperatures taken over a 5-year period at nine stations in the northern hemisphere are summarized in order to provide information on the temperatures likely to be encountered during airplane and missile operations up to 100,000 feet. The results are in general agreement with those from previous investigations of upper-air temperatures and indicate that the mean temperatures from the tropopause to 100,000 feet tend to increase fairly regularly and rapidly for southern locations, whereas a smaller increase occurs for more northerly locations. The scatter in the temperatures about the mean generally decreased with increasing altitude from the tropopause to 100,000 feet. Little, if any, effect of location upon the temperature was apparent for altitudes above about 90,000 feet.

INTRODUCTION

Data on the atmospheric temperatures at different altitudes have a number of applications during both the design phases and the actual operations of high-speed airplanes and missiles. Measurements of the upper-air temperatures were summarized some time ago by the United States Weather Bureau in reference 1 in order to provide information on the frequency with which given temperatures might be expected at different altitudes and locations. These data covered radiosonde observations made over a 5-year period from locations within the continental United States and in adjoining areas and, because of limitations of the sounding equipment, were restricted to altitudes of about 50,000 feet.

With the more recent design of airplanes and missiles having much greater altitude and range capabilities, temperature data are now needed for higher altitudes and for other areas throughout the world. A summary of radiosonde temperature measurements was accordingly undertaken

by the National Advisory Committee for Aeronautics to extend the results in reference 1 to altitudes of about 100,000 feet and to several locations in the northern hemisphere. Although both the altitude and the area coverage of the results represented by this study are still limited, an effort was made through choice of station locations to obtain temperature data which could be considered representative of some of the wider climatological or geographical areas of the northern hemisphere.

Acknowledgment is made to the Office of Climatology of the United States Weather Bureau for their assistance in selecting the upper-air stations most suitable for the present study and to the National Weather Records Center for their services in processing the original observational data.

PRESENTATION OF DATA

Scope

Compilation of the available atmospheric temperature and pressure measurements to an altitude of 100,000 feet for a large portion of the earth would be a task of great magnitude. The compilation for continental United States, given in reference 1, and that for the North American continent, given in reference 2, suggest that the main temperature features, particularly at pressure levels corresponding to high altitudes, can be disclosed with significantly smaller effort by considering data for a few radiosonde stations selected to represent several broad climatological regions and geographic locations. Further, a survey of the available radiosonde data indicated that temperature and pressure measurements up to an altitude of about 100,000 feet and extending over a time interval of several years exist only for locations in the northern hemisphere. In view of these considerations, nine widely dispersed radiosonde stations in the northern hemisphere were selected to represent predominantly arctic, semitropical, maritime, and continental influences. Radiosonde observations covering a 5-year period were used for each station. The stations selected, their climatological regions, the time period covered by the observations, and the total number of radiosonde soundings from each station are listed in the following table:

Station	Influences represented	Period of observation	No. of soundings
Thule, Greenland	Arctic	Jan. 1951 - Dec. 1955	1,785
Barrow, Alaska	Arctic	Jan. 1951 - Dec. 1955	1,816
San Juan, P. R.	Semitropical	Jan. 1951 - Dec. 1955	1,823
Ocean station vessel Echo (lat. 35° N., long. 48° W.)	Maritime	Jan. 1951 - Dec. 1955	1,751
Ocean station vessel Victor (lat. 34° N., long. 164° E.)	Maritime	Sept. 1951 - Aug. 1956	1,767
International Falls, Minn.	Continental	Jan. 1951 - Dec. 1955	1,793
El Paso, Tex.	Continental	Jan. 1951 - Dec. 1955	1,820
Itazuki (Fukuoka), Japan	Continental	Jan. 1951 - Dec. 1955	1,772
Wiesbaden, Germany	Continental	Jan.-Apr., June-Aug., Oct.-Nov., 1950 Jan., Mar., May, Sept., Dec., 1951 Feb., Apr.-Dec., 1952 Jan. 1953 - Dec. 1955	1,752

The data for the stations in the table were confined to the daily radiosonde observation taken near 2300 e.s.t. (0300 Z). Because of differences in longitude of the stations, some of the data represent nighttime observations while others represent daytime observations. Temperature differences resulting from these differences in local time of the soundings are not considered significant for the higher altitudes which are of particular interest in this study. References 3 and 4, for example, indicate that diurnal temperature variations at the higher altitudes amount only to about 0.5° C. It may also be noted that with the exception of the data for Wiesbaden, Germany, each set of soundings covered about the same continuous 5-year period.

Results

The results are summarized in table I in terms of the frequencies f and the cumulative probability distributions cpd of the temperatures t observed at given altitudes for each of the nine stations. For the different stations, separate distributions are given for each month of the combined 5-years' sample of data and for the total 5-years' sample. The temperature data given in the table were obtained at the standard reporting pressure levels of 850, 700, 500, 300, 200, 100, 50, 30, 20, and 10 millibars. For convenience, these pressure levels are expressed as the corresponding geometric altitudes in the standard aeronautical atmosphere specified in references 2 and 5.

Each entry in table I refers to a temperature observation within a class interval of 2°C . A frequency value for a temperature of 10°C , for example, indicates the number of observations between 10°C and 11.9°C , and a frequency value for a temperature of -10°C indicates the number of observations between -10°C and -8.1°C . The cumulative probability distributions indicate the percentage of observations for which the temperatures exceeded the specified values. It was considered that tabular presentation would place the data in the form most suitable for a variety of uses, such as determining seasonal variations at a given location, the mean, or the standard deviation of the temperatures about the mean at different altitudes.

It might be noted from table I that the number of observations obtained decreases rapidly with altitude, particularly for altitudes above 67,500 feet, because of limitations in the performance of balloon sounding equipment. For Wiesbaden, Germany, only three observations were obtained at altitudes above 67,500 feet in January and February because of interrupted weather services during these months over parts of the 5-year period selected for study. For completeness, however, all observations were tabulated, regardless of how few were available. In addition, all singularities noted during the tabulation of the data by the National Weather Records Center were checked against data reported by previous or following soundings.

It might be pointed out that for each altitude table I approximates a graph in which temperature is the ordinate, time is the abscissa, and the curves are formed by lines running through constant values of the cumulative probability distributions. Thus, the variations in the temperature with season, altitude, and location may be readily observed from the table.

DISCUSSION

Table I indicates large monthly and seasonal temperature variations at all altitudes for the northern locations as compared with somewhat smaller variations for the southern locations. A few examples of the extreme variations in the temperature during summer months (June, July, and August) and winter months (December, January, and February) at altitudes above the tropopause are summarized in the following table for stations representing arctic, semitropical, and maritime regions.

Station	Temperature range, °C, at altitude of —					
	67,500 ft		78,500 ft		87,000 ft	
	Summer	Winter	Summer	Winter	Summer	Winter
Thule, Greenland (arctic) { t Δt	-40 to -50 10	-42 to -82 40	-38 to -50 12	-44 to -82 38	-36 to -48 12	-----
San Juan, P. R. (semitropical) { t Δt	-56 to -64 8	-60 to -80 20	-44 to -60 16	-50 to -70 20	-48 to -54 6	-46 to -64 18
Ocean station vessel Victor (maritime) { t Δt	-54 to -64 10	-52 to -70 18	-46 to -58 12	-46 to -64 18	-44 to -54 10	-42 to -60 18

The primary indications of the preceding summary are the generally colder temperatures and the larger spread in the temperatures at all locations for the winter months than for the summer months. In similar investigations (ref. 6, for example) tendencies have been found for the temperatures at altitudes near 100,000 feet to be somewhat colder for northern locations than for more southerly locations. These latitude effects are not particularly apparent in the foregoing summary or in table I. The relatively few observations at 102,000 feet in the present summary, however, do not permit definite conclusions to be made in regard to such tendencies in the temperatures.

For a better illustration of the variations in temperature at the different altitudes, the mean temperature and the standard deviation of the temperatures about the mean are plotted against altitude in figure 1 for the 5-years' set of observations taken at Barrow, Alaska, ocean station vessel Victor, International Falls, Minnesota, and San Juan, Puerto Rico. The standard deviation σ is a useful measure of the scatter in the data about the mean and indicates the range that includes approximately 68 percent of the observations. The points in figure 1 are plotted slightly above or below the given altitudes for ease in distinguishing the average temperature and the values of σ . The variations in temperature with altitude for the standard atmosphere of references 2 and 5 are also shown by the curve in figure 1 for comparison with the observed data.

The much colder temperatures at tropopause levels and the wide departures from the temperatures for the standard atmosphere are evident for the southern locations from inspection of figure 1. Also, conditions in the stratosphere for the southern locations are characterized by a fairly large increase in the temperatures with altitude, while a small increase occurs for the more northerly locations. The mean temperatures for the high and low latitudes appear to converge at about 90,000 feet. Similar variations in the mean temperature with altitude above the tropopause for different latitudes are discussed in references 6 and 7.

The values of σ in figure 1 point out the very small variations in troposphere temperatures throughout the year for semitropical locations and the much larger variations for high-latitude stations. Above the tropopause, the temperature spreads generally decrease as altitude increases to 102,000 feet. The comparatively small amount of data obtained at the highest levels does not permit complete confidence to be placed in the values of σ at these altitudes, but in general it appears that the scatter in the temperatures about the mean values is represented by a value for σ of 10°C or more at low altitudes and less than 5°C at the higher altitudes.

CONCLUDING REMARKS

The preceding summary of the upper-air temperature measurements taken at nine radiosonde stations over a 5-year period provides basic temperature statistics for use in airplane and missile design studies. The stations were selected to represent given geographic or climatological influences, and the expected wide departures in the temperatures from those specified for standard atmospheric conditions were noted. The scatter in the temperatures at different altitudes agrees with the results from other investigations, and in terms of the standard deviations of the temperatures about the mean, frequently exceed 10°C in the troposphere and are less than 5°C for altitudes from the tropopause to 100,000 feet.

Langley Aeronautical Laboratory,
National Advisory Committee for Aeronautics,
Langley Field, Va., August 23, 1957.

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TABLE I.- SUMMARY OF RADIOSONDE MEASUREMENTS OF UPPER-AIR TEMPERATURES

Alt., ft	t, °C	Jan.		Feb.		March		April		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.		Total		t, °C		
		f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %			
(a) Thule, Greenland																														
5,000	8											1	1	1	1	2	1									4	1	8		
	6											3	3	3	3	2	3									13	1	6		
	4											5	6	5	8	2	4									12	2	4		
	2											7	11	18	20	21	18									47	4	2		
	0											17	22	39	45	33	40									99	10	0		
	-2											29	39	30	64	29	59									105	18	-2		
	-4	2	1					1	1			7	11	24	55	27	82			2	1	1	1	2	1	105	22	-4		
	-6	4	4					7	6			9	16	26	72	22	96			4	6	1	2	2	5	123	29	-6		
	-8			1	1							12	16	27	13	81	6	100			9	12	3	4	1	3	91	34	-8	
	-10	6	8	1	3			12	20	24	43	18	93			1	99			23	27	8	9	2	5	122	40	-10		
	-12	5	11	1	4			14	29	27	61	7	97							25	44	3	11	3	7	115	47	-12		
	-14	12	17	3	6	7	9	17	41	20	74	3	99							18	56	21	25	3	9	110	53	-14		
	-16	9	25	3	8	7	14	12	49	20	87	1	100							19	69	14	36	8	14	102	59	-16		
	-18	13	34	5	12	16	24	13	58	8	92									19	81	20	49	12	22	107	65	-18		
	-20	14	43	14	22	15	34	16	69	5	95									11	89	21	63	19	35	115	71	-20		
	-22	9	49	11	30	19	46	12	77	2	97									8	94	16	74	14	45	91	76	-22		
	-24	8	54	12	39	9	52	6	81	3	99									5	97	18	86	16	55	77	81	-24		
	-26	15	64	15	50	13	61	9	87	1	99									2	99	9	92	19	68	83	85	-26		
	-28	14	73	21	66	17	72	4	90	1	100									2	100	4	95	17	80	80	90	-28		
	-30	15	81	18	79	18	84	4	93													7	99	14	91	78	94	-30		
	-32	16	93	5	83	11	91	3	95													1	100	11	98	47	97	-32		
	-34	3	95	11	91	7	93	4	97															3	100	28	98	-34		
	-36	5	99	5	95	5	99	4	100																	19	99	-36		
	-38	2	100	2	96	2	100																			6	100	-38		
	-40			5	100																					5	100	-40		
10,000	0											2	1	1	1											3	1	0		
	-2											5	5	13	14	11	9			4	3					10	1	-2		
	-4											17	17	32	35	28	27			4	6					33	3	-4		
	-6	1	1							5	3	19	29	17	46	39	53			11	14	1	1			82	7	-6		
	-8	1	1							6	7	19	42	27	63	33	74			11	21	1	1			93	12	-8		
	-10							1	1													1	1			99	18	-10		
	-12	1	2	1	1			2	2	9	13	30	62	33	85	15	84			26	40	2	3			119	25	-12		
	-14	2	3	1	2	1	1	5	5	16	24	22	77	18	97	13	93			18	53	8	8	1	1	108	31	-14		
	-16	3	5	1	2	3	3	14	15	15	34	16	87	3	99	6	97			16	59	3	3	1	3	99	36	-16		
	-18	9	11	1	3	5	6	18	27	27	51	8	93	4	99	17	77			17	30	11	11	4	5	123	43	-18		
	-20	7	16	3	5	7	11	21	42	32	72	6	97							25	47	10	17	7	10	133	51	-20		
	-22	16	26	4	8	8	16	15	52	21	86	2	98							14	59	14	27	5	14	114	57	-22		
	-24	17	38	7	13	20	29	21	66	10	93	2	99							16	69	31	47	17	25	146	65	-24		
	-26	17	49	12	22	22	43	18	78	6	97									19	82	21	61	23	41	139	73	-26		
	-28	19	61	18	35	18	55	9	84	2	98									12	90	22	76	17	52	119	80	-28		
	-30	18	73	17	48	19	68	5	88	2	99									8	95	11	83	21	66	101	85	-30		
	-32	12	81	24	65	16	78	3	90											4	98	12	91	22	81	93	91	-32		
	-34	12	89	15	77	11	86	5	93	1	100									1	99	7	96	13	90	65	94	-34		
	-36	10	95	12	85	14	95	3	95											2	100	5	99	10	97	56	97	-36		
	-38	3	97	8	91	2	96	3	97													1	100	3	99	20	98	-38		
	-40	2	99	4	94	6	100	2	99															2	100	16	99	-40		
	-42	2	100	2	96			1	99																	5	100	-42		
	-44																									4	100	-44		
	-46			6	100																					1	100	-46		
18,000	-16											1	1	3	2	1	1									5		-16		
	-18											1	1	10	9	5	4									16	1	-18		
	-20											8	7	19	22	12	12			2	1					41	4	-20		
	-22											15	17	21	36	29	32			5	5					76	8	-22		
	-24	1	1									19	30	24	52	36	57			13	15					97	14	-24		
	-26	2	2									7	10	33	53	30	72			17	27	4	4			128	21	-26		
	-28	1	3	2	2	1	1	8	8	11	17	23	69	24	88	13	86			22	43	6	8	2	1	113	28	-28		
	-30	1	3			4	4	7	12	18	30	22	84	11	95	11	94			23	59	8	14	3	3	1	109	34	-30	
	-32	4	6	1	2	4	7	13	21	31	50	14	93	4	98	5	97			19	73	15	24	8	9	4	3	122	41	-32
	-34	9	12	1	3	9	13	17	33	26	68	5	97	2	99	2	99			15	84	22	39	10	16	6	8	124	48	-34
	-36	14	22	4	6	12	22	22	48	24	84	4	99	1	100					8	90	20	53	10	23	10	14	131	56	-36
	-38	19	35	7	12	18	34	25	65	18	96									7	95	21	67	31	44	15	25	161	65	-38
	-40	24	51	15	24	20	48	18	77	4	99	1	100							4	98	20	81	25	61	21	39	192	74	-40
	-42	24	67	22	41	27	67	14	87											2	99	16	92	24	78	35	63	144	83	-42
	-44	18	79	25	61	15	77	5	90	2	100									1	100	4	95	12	86	21	77	103	89	-44
	-46	17	91	29	84	18	90	6	95											4	99	10	93	21	92	107	95	-46		
	-48	7	95	11	92	11																								

TABLE I. - SUMMARY OF RADIOSONDE MEASUREMENTS OF UPPER-AIR TEMPERATURES - Continued

Alt., ft	t, °C	Jan.		Feb.		March		April		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.		Total		t, °C
		f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	
(a) Thule, Greenland - Continued																												
38,500	-36													1	2											1		-36
	-38													3	3											11	1	-38
	-40													13	14											49	4	-40
	-42													21	22											117	12	-42
	-44													46	56											149	22	-44
	-46	5	4											31	79											187	34	-46
	-48	6	9											18	92											179	46	-48
	-50	15	22											10	95											186	99	-50
	-52	18	37											2	96											179	71	-52
	-54	14	49											2	98											127	79	-54
	-56	5	53																							91	86	-56
	-58	5	57																							68	90	-58
	-60	7	63																							41	93	-60
	-62	11	72																							11	84	-62
	-64	15	85																							6	89	-64
	-66	13	96																							6	94	-66
	-68	2	98																							2	95	-68
-70	2	99																							2	97	-70	
-72	1	100																							1	98	-72	
-74																									4	100	-74	
53,000	-38																									2		-38
	-40																									16	2	-40
	-42																									76	9	-42
	-44																									1	1	-44
	-46	2	3																							1	3	-46
	-48	9	16																							3	7	-48
	-50	13	34																							1	8	-50
	-52	3	38																							6	16	-52
	-54	1	39																							3	20	-54
	-56	2	42																							6	28	-56
	-58	3	47																							13	94	-58
	-60	3	51																							5	98	-60
	-62	4	56																							2	100	-62
	-64	5	63																							9	99	-64
	-66	6	72																							9	99	-66
	-68	6	80																							5	84	-68
	-70	10	94																							5	91	-70
-72	2	97																							4	96	-72	
-74	2	100																							2	99	-74	
-76																									1	100	-76	
67,500	-40																									25	4	-40
	-42																									92	19	-42
	-44																									108	56	-44
	-46																									82	49	-46
	-48																									52	58	-48
	-50	3	21																							34	63	-50
	-52																									24	67	-52
	-54	4	50																							1	13	-54
	-56	3	71																							3	26	-56
	-58																									2	35	-58
	-60																									4	52	-60
	-62	2	86																							17	77	-62
	-64																									10	93	-64
	-66																									3	98	-66
	-68																									1	100	-68
	-70																									4	93	-70
	-72																									1	97	-72
-74	1	93																							2	99	-74	
-76	1	100																							1	100	-76	
-78																									1	83	-78	
-80																									2	91	-80	
-82																									1	96	-82	
78,500	-38																									1		-38
	-40																									43	14	-40
	-42																									72	38	-42
	-44																									55	56	-44
	-46																									32	67	-46
	-48																									24	74	-48
	-50																									13	79	-50
	-52	1	50																							6	81	-52
	-54	1	100																							16	86	-54
	-56																									6	88	-56
	-58																									9	91	-58
	-60																									10	94	-60
	-62																									4	96	-62
	-64																									4	98	-64
	-66																									4	99	-66
	-68																									1	100	-68
	-70																									1	100	-70
-72																									1	100	-72	
-74																									1	100	-74	

TABLE I.- SUMMARY OF RADIOSONDE MEASUREMENTS OF UPPER-AIR TEMPERATURES - Continued

[illegible]

TABLE I. - SUMMARY OF RADIOSONDE MEASUREMENTS OF UPPER-AIR TEMPERATURES - Continued

Alt., ft	t, °C	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	t, °C
		f cpd %	f cpd %	f cpd %	f cpd %	f cpd %	f cpd %	f cpd %	f cpd %	f cpd %	f cpd %	f cpd %	f cpd %	f cpd %	
(b) Barrow, Alaska - Continued															
18,000	-12						1 1	1 1						2	-12
	-14						2 2	6 5						14	-14
	-16						1 3	12 12	7 9					20	-16
	-18						6 7	27 30	21 23					54	-18
	-20	1 1			1 1		15 17	37 54	26 40	4 3	3 2	1 1		88	-20
	-22	3 3		2 1	3 3	3 2	31 39	39 80	32 61	8 8	4 5			125	-22
	-24	1 3		1 2	3 5	16 12	28 58	16 90	23 77	22 24	8 10			119	-24
	-26	2 5		3 4	9 11	26 29	36 83	8 95	16 87	35 48	12 18	2 2	1 1	150	-26
	-28	6 9	1 1	7 8	4 13	28 47	14 93	7 100	12 95	21 63	10 24	3 4		113	-28
	-30	5 12	2 2	10 15	12 21	32 68	10 100		6 99	28 82	17 36	12 12	6 5	140	-30
	-32	8 17	3 4	5 18	16 32	19 81			1 100	15 92	28 54	17 24	5 9	117	-32
	-34	11 24	9 11	14 27	17 43	19 93				6 97	24 70	25 41	22 23	147	-34
	-36	13 33	18 24	13 36	33 65	10 99				4 99	28 88	29 61	20 36	168	-36
	-38	20 46	20 38	32 56	26 83	1 100				1 100	7 93	21 75	14 45	142	-38
	-40	23 61	23 54	33 77	18 95						10 99	21 89	25 61	153	-40
	-42	19 74	27 74	16 88	6 99						1 100	10 96	30 81	109	-42
	-44	16 84	16 85	13 96	2 100							3 98	22 95	72	-44
	-46	16 95	12 94	4 99								3 100	5 99	40	-46
	-48	6 99	7 99	1 99										16	-48
	-50	2 100	2 100	1 100									2 100	5	-50
30,000	-38							3 2						3	-38
	-40						1 1	2 1						5	-40
	-42					2 1	2 2	12 11	5 5					21	-42
	-44	1 1	2 2	1 1	1 1	2 3	8 8	21 25	16 16	2 1				54	-44
	-46	2 2	3 4		2 10	9	14 18	34 47	29 36	2 3	4 3			100	-46
	-48	3 4	3 6	10 7	6 6	14 18	26 37	40 73	40 64	8 9	12 11			164	-48
	-50	10 11	7 11	7 12	12 14	21 32	34 62	31 94	28 83	26 28	19 20	3 3	4 3	196	-50
	-52	10 18	19 25	18 24	23 30	36 56	33 86	8 99	17 95	37 54	17 31	17 15	5 7	240	-52
	-54	33 40	19 39	30 43	25 46	41 82	14 96	2 100	6 99	42 85	9 37	33 38	19 19	273	-54
	-56	32 62	19 53	32 64	39 73	21 96	6 100		1 100	15 96	24 53	37 64	30 38	256	-56
	-58	24 79	29 74	23 79	24 89	6 100				4 99	35 77	29 84	33 60	207	-58
	-60	14 88	22 90	22 94	14 98					2 100	30 97	18 97	28 78	150	-60
	-62	13 97	8 96	9 99	3 100						3 99	5 100	28 96	69	-62
	-64	3 99	2 98								1 100		4 99	10	-64
	-66	1 100	2 99	1 100									2 100	6	-66
	-68		1 100											1	-68
38,500	-40			2 1			1 1	5 3	2 1					10	-40
	-42		8 6	3 3		3 2	5 4	17 15	8 7					44	-42
	-44	2 2	4 9	3 5	5 4	12 10	25 23	20 28	23 22	3 2	2 1			99	-44
	-46	10 9	8 15	8 11	10 10	28 29	27 43	30 48	22 37	15 13	5 5			144	-46
	-48	7 14	15 27	16 22	27 29	54 64	35 68	20 61	34 61	26 32	7 10	6 4	3 3	250	-48
	-50	19 29	22 44	24 38	40 57	24 80	17 81	21 75	20 74	29 53	19 24	18 17	8 8	261	-50
	-52	20 44	15 55	30 58	22 72	14 89	10 88	11 82	12 82	30 74	27 43	39 45	25 25	255	-52
	-54	24 62	23 73	16 69	21 87	7 94	5 92	7 87	5 86	15 85	24 60	28 65	28 44	203	-54
	-56	22 79	18 87	24 85	9 93	4 97	8 98	5 90	8 91	11 93	16 72	26 84	22 59	173	-56
	-58	6 83	11 95	9 91	3 95	4 99	2 99	5 93	7 96	5 96	16 84	13 93	17 71	98	-58
	-60	7 89	2 97	6 95	1 96	1 100	1 100	6 97	2 97	4 99	6 88	3 95	10 78	49	-60
	-62	5 92	1 98		3 98			4 100	4 100	1 100	2 89	2 96	7 82	29	-62
	-64	1 93	2 99	3 97	2 99						4 92	3 99	9 88	24	-64
	-66	1 94	1 100	2 99	1 100						6 96	2 100	8 94	21	-66
	-68	3 96									3 99		4 97	12	-68
	-70	5 100		2 100							1 99		4 99	10	-70
	-72										1 100		1 100	2	-72
53,000	-38		1 1	1 1										2	-38
	-40		1 2	2 2										3	-40
	-42	3 3	3 5	7 8				1 1				1 1	1 1	16	-42
	-44	2 4	6 11	6 12	4 3	7 5	11 8	39 27	12 9			1 2	1 2	89	-44
	-46	7 10	8 18	8 19	13 13	21 19	67 59	57 66	59 51	11 8	4 4	4 5	4 5	263	-46
	-48	24 31	12 30	9 25	26 32	52 54	40 89	38 91	45 83	30 31	4 7	18 18	8 12	306	-48
	-50	18 47	16 45	16 38	30 54	56 92	12 98	12 99	21 98	63 78	12 18	22 35	13 23	291	-50
	-52	19 64	18 63	27 59	32 78	12 100		3 100	1 100	26 98	30 45	35 62	12 33	218	-52
	-54	12 74	14 76	28 80	20 93					3 100	21 63	16 74	21 51	135	-54
	-56	11 84	20 95	11 89	10 100						20 81	14 85	13 62	99	-56
	-58	10 92		7 94							11 91	9 92	11 72	46	-58
	-60	5 97	2 97	2 95							7 97	10 99	6 77	32	-60
	-62	1 97	2 99	1 96							1 98	1 100	12 87	18	-62
	-64	3 100	1 100	3 100							1 99		7 93	17	-64
	-66										1 100		4 97	5	-66
	-68												2 98	2	-68
	-70												1 99	1	-70
	-72												1 100	1	-72

TABLE I.- SUMMARY OF RADIOSONDE MEASUREMENTS OF UPPER-AIR TEMPERATURES - Continued

Alt., ft	t, °C	Jan.		Feb.		March		April		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.		Total		t, °C
		f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	
(b) Barrow, Alaska - Concluded																												
67,500	-36 -38 -40 -42 -44 -46 -48 -50 -52 -54 -56 -58 -60 -62 -64 -66 -68 -70					1	1																			1	-36 -38 -40 -42	
						2	2																			3	-38 -40 -42 -44	
						3	3																			4	-40 -42 -44 -46	
		3	5	2	6							3	3													10	-42 -44 -46 -48	
		1	6	2	11	2	15			3	2	44	42	73	61	16	12			1	1					13	-44 -46 -48 -50	
		4	13	1	14	5	22	3	3	27	24	50	87	44	94	38	41	5	5	2	9					19	-46 -48 -50 -52	
		10	29	4	25	5	28	24	24	40	57	13	99	8	100	59	86	4	8	1	2					29	-48 -50 -52 -54	
		4	35	1	28	8	39	23	44	33	84	1	100			16	99	23	29							46	-50 -52 -54 -56	
		12	57	5	42	4	44	21	62	16	97					2	100	46	70	1	4	13	36	9	65	123	-52 -54 -56 -58	
		7	87	8	64	6	51	25	84	4	100							23	92	11	24	12	34	7	79	110	-54 -56 -58 -60	
		3	92	4	94	13	90	5	100									8	99	15	49	7	74	1	83	47	-56 -58 -60 -62	
		1	94	1	97	5	96											1	100	8	84	9	87	3	90	27	-58 -60 -62 -64	
		2	97	1	100															6	95	9	97	2	94	18	-60 -62 -64 -66	
		2	100																	3	100	2	100	1	96	8	-62 -64 -66 -68	
						2	99																	1	98	3	-64 -66 -68 -70	
						1	100																			1	-66 -68 -70 -72	
78,500	-40 -42 -44 -46 -48 -50 -52 -54 -56 -58 -60 -62 -64											1	2		1	1											1	-40 -42 -44 -46
												6	12	18	25	4	5										3	-42 -44 -46 -48
				1	9	1	6					29	60	37	75	10	16										43	-44 -46 -48 -50
		1	11	3	36	1	13	3	5	11	35	22	97	17	97	29	48	1	2							1	57	-46 -48 -50 -52
								7	18	6	47	1	98	2	100	30	82									2	86	-48 -50 -52 -54

TABLE I.- SUMMARY OF RADIOSONDE MEASUREMENTS OF UPPER-AIR TEMPERATURES - Continued

Alt., ft	t, °C	Jan.		Feb.		March		April		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.		Total		t, °C			
		f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %				
(c) San Juan, Puerto Rico - Concluded																															
38,500	-50	1	1	1	1	6	4																				-50				
	-52	21	15	7	6	23	19	6	4	3	2					2	1	5	3			1	1	3	2	71	5	-52			
	-54	42	44	56	47	45	49	39	31	23	18	2	1	4	4	21	15	19	17	24	16	23	16	31	23	331	24	-54			
	-56	55	83	38	75	49	82	67	77	65	64	52	39	39	30	80	69	79	71	78	68	99	84	62	64	763	67	-56			
	-58	22	98	29	96	24	98	33	100	47	97	70	89	87	89	43	98	35	95	47	99	23	100	52	99	512	97	-58			
	-60	2	99	6	100	2	99			3	99	13	99	16	99	3	100	7	100	2	100			1	100	55	100	-60			
	-62	1	100			1	100			2	100	2	100												6	100	6	100	-62		
	-66													1	100											1	100	1	100	-66	
53,000	-68																	3	3							4		-68			
	-70											10	9	14	11	5	4	8	9	1	1					38	3	-70			
	-72	2	2					5	4	7	4	24	30	40	41	26	23	26	31	6	6			3	2	139	12	-72			
	-74	10	9	7	5	14	15	14	19	44	69	52	81	62	68	26	53	25	25	9	7			5	6	273	30	-74			
	-76	25	28	22	23	38	32	41	49	37	52	19	86	24	99	35	93	43	89	35	53	25	27	25	24	369	54	-76			
	-78	46	63	60	69	55	72	45	85	35	83	8	93	2	100	8	99	12	99	30	76	53	68	47	58	401	80	-78			
	-80	35	89	28	91	32	95	13	96	15	96	5	97			1	100	1	100	22	94	33	94	31	80	216	94	-80			
	-82	14	100	12	100	6	99	5	100	4	100	2	99							4	98	6	98	28	100	83	100	-82			
	-84					1	100					1	100							2	100	1	99			5	100	-84			
	-86																					1	100			1	100	-86			
67,500	-54					1	1			1	1																2		-54		
	-56									1	3	2	3	2	2											5	1	-56			
	-58					1	2	2	2	4	6	5	9	6	9	11	10	2	3	2	2					33	4	-58			
	-60	3	4	2	2	2	4	9	13	19	33	18	32	32	43	35	42	16	24	6	9	5	6	2	2	149	18	-60			
	-62	3	8	2	5	3	7	11	26	16	53	30	70	39	84	44	83	32	66	32	47	23	31	8	12	243	41	-62			
	-64	5	14	11	18	15	21	25	55	16	74	24	100	15	100	19	100	19	91	30	82	26	60	18	33	223	63	-64			
	-66	16	35	23	46	28	48	23	81	12	90							7	100	11	95	23	86	27	66	170	79	-66			
	-68	18	58	17	68	27	74	14	98	8	100									4	100	13	100	18	87	119	90	-68			
	-70	25	90	16	86	18	91	1	99																7	95	67	97	-70		
	-72	5	96	9	96	7	98	1	100																2	98	24	99	-72		
	-74	1	97	3	100	2	100																		2	100	8	100	-74		
	-76	1	99																								1	100	-76		
	-80	1	100																								1	100	-80		
78,500	-44											1	2													1		-44			
	-46											1	5													1		-46			
	-48																									1		-48			
	-50			1	2	1	1	3	6	2	4	3	11			1	2	2	5			1	2			15	3	-50			
	-52			1	4	8	12	1	8	5	15	2	16	6	12	7	13	1	8			4	12	1	2	36	9	-52			
	-54			4	13	7	22	11	30	13	42	15	50	13	42	17	40	6	23	3	6	16	40	12	23	119	28	-54			
	-56	8	17	9	31	24	55	23	76	20	83	18	91	25	92	22	76	18	69	14	31	12	60	16	52	209	61	-56			
	-58	12	44	13	58	19	81	9	94	8	100	5	98	4	100	13	97	11	97	24	75	12	81	14	77	142	83	-58			
	-60	18	83	13	85	10	95	3	100			1	100			2	100	1	100	11	95	9	97	10	95	78	96	-60			
	-62	4	96	5	96	3	99													3	100	2	100	2	98	21	99	-62			
	-64	1	98	2	100	1	100																		1	100	5	100	-64		
	-70	1	100																								1	100	-70		
87,000	-44					1	3			1	8															1		-44			
	-46													1	5											4	2	-46			
	-48			3	13	4	17	6	30	3	31	3	27	3	21	2	12	1	13	1	4	5	18	1	6	31	15	-48			
	-50			3	25	13	60	4	50	7	85	6	82	5	47	6	47	1	20	3	16	17	79	5	35	72	44	-50			
	-52	6	33	4	42	5	77	4	70	1	92	1	91	8	90	7	88	4	47	10	56	3	89	3	53	56	68	-52			
	-54	4	50	7	71	3	87	5	95	1	100	1	100	2	100	2	100	7	93	11	100	3	100	4	77	50	88	-54			
	-56	5	71	4	88	2	93	1	100																	2	88	15	94	-56	
	-58	6	96	2	96	2	100																			2	100	12	99	-58	
	-62			1	100																							1	100	-62	
	-64	1	100																								1	100	1	100	-64
102,000	-42					1	17	1	50																	2	15	-42			
	-44					1	33																			1	23	-44			
	-46					3	83							1	100											4	54	-46			
	-48					1	100																			3	77	-48			
	-50							1	100																	1	85	-50			
	-54	1	67																							1	92	-54			
	-62	1	100																							1	100	1	100	-62	
(d) Ocean station vessel Echo																															
5,000	20																									1		20			
	18																									7	1	18			
	16																									88	6	16			
	14																									335	25	14			
	12	8	6	3	2	3	2	5	4	32	25	64	71	52	94	15	98	36	92	41	66	34	31	16	12	309	42	12			
	10	22	21	16	14	11	9	34	27	52	60	30	91	9	100	8	97	17	78	33	55	29	93	26	4	264	57	10			
	8	34	44	37	40	28	28	43</																							

TABLE I. - SUMMARY OF RADIOSONDE MEASUREMENTS OF UPPER-AIR TEMPERATURES - Continued

Alt., ft	t, °C	Jan.		Feb.		March		April		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.		Total		t, °C		
		f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %			
(d) Ocean station vessel Echo - Continued																														
10,000	10																													
	8	1	1																											
	6																													
	4	12	9	13	12	7	5	10	6	38	29	37	28	66	52	90	87	62	74	41	44	16	14	3	2	2	1	112	7	8
	2	29	29	13	12	10	11	35	32	61	69	30	99	76	79	66	95	34	97	48	78	47	49	14	19	176	24	6	2	
	0	37	55	38	39	37	35	45	62	30	89	2	100	2	100	1	100	4	100	17	91	39	77	34	43	240	64	2	2	
	-2	31	76	35	64	29	54	33	84	7	94									2	97	3	96	26	83	166	87	-2	-2	
	-4	26	94	25	82	37	78	17	95	4	97									3	99	5	100	16	94	133	95	-4	-4	
	-6	5	97	12	91	17	90	2	97	4	99									1	100			6	99	47	98	-6	-6	
	-8	3	99	5	94	11	97	2	98	1	100													1	99	23	99	-8	-8	
	-10	1	100	7	99	4	99	1	99																1	100	14	100	-10	-10
	-12			1	100			2	100																		3	100	-12	-12
	-14					1	100																				1	100	-14	-14
18,000	-6																													
	-8																													
	-10																													
	-12	8	6	2	2	2	3	14	12	49	38	61	84	60	91	27	99	37	70	26	43	11	9	4	4	211	26	-10	-10	
	-14	21	20	13	11	12	12	28	32	47	71	21	99	12	99	1	100	6	100	23	89	32	67	22	29	238	61	-14	-14	
	-16	29	41	38	39	29	33	37	57	32	93	2	100	2	100					9	96	25	87	44	61	247	76	-16	-16	
	-18	41	70	24	56	28	53	25	75	3	95									2	98	13	97	26	80	162	85	-18	-18	
	-20	18	82	32	80	28	73	24	92	3	97									2	99	4	100	14	91	125	93	-20	-20	
	-22	19	96	7	85	19	87	8	97	4	99																			

TABLE I.- SUMMARY OF RADIOSONDE MEASUREMENTS OF UPPER-AIR TEMPERATURES - Continued

Alt., ft	t, °C	Jan.		Feb.		March		April		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.		Total		t, °C		
		f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %			
(d) Ocean station vessel Echo - Concluded																														
75,500	-40									1	2													1	3	1		-40		
	-42	1	3																								1		-42	
	-44	2	10	1	5							2	3	1	2	1	1								3	15	160	43	-44	
	-46	3	20			1	5	2	8	2	7	12	21	9	16	10	16							1	4	40	10	-46		
	-48	1	23	1	11			10	48	22	54	34	73	35	73	32	61	15	28	6	15	1	4			119	67	-48		
	-50	2	30			2	14	6	72	17	91	16	97	16	98	27	100	24	72	7	33	2	11			68	81	-50		
	-52	5	47	3	26			7	46	6	96	3	98					13	96	16	74	6	33	7	36	43	89	-52		
	-54	8	73			7	77	1	100	1	100			1	100			1	98	9	97	8	63	7	58	31	96	-54		
	-56	3	83	9	74																			4	70	17	99	-56		
	-58	4	97	5	100	5	100											1	100			2	100	6	88	4	100	-58		
	-60	1	100																					1	100	1	100	-60		
	-62																												-62	
	-64																												-64	
	-66																												-66	
87,000	-40																												-40	
	-42	1	11					1	10																				-42	
	-44																							1	11	1	1		-44	
	-46	1	22							1	8	8	22	3	12	4	11									17	10		-46	
	-48	1	33					1	20	5	50	17	68	8	42	14	50	2	11			1	11	2	33	51	36		-48	
	-50	1	44	1	14	3	21	4	60	2	67	7	87	11	85	12	83	7	47	3	38			1	44	51	42		-50	
	-52					6	71	2	80	3	92	4	97	3	96	6	100			2	63	1	22	1	44	30	78		-52	
	-54	1	56	1	29	6	71	1	79	2	100	1	100	1	100					2	88	1	33	1	56	17	86		-54	
	-56	2	78	3	71	1	79	2	100									1	100	1	100	6	100	1	67	17	95		-56	
	-58			1	86																			3	100	5	97		-58	
	-60	2	100	1	100	1	93																			4	100		-60	
	-62					1	100																			1	100		-62	
	-64																												-64	
	-66																												-66	
102,000	-44									1	100	1	33			1	100									1	11		-44	
	-46																									4	56		-46	
	-48																									2	78		-48	
	-50																									1	89		-50	
	-52																												-52	
	-54	1	100																							1	100		-54	
(e) Ocean station vessel Victor																														
5,000	20									1	1	2	1	1	1	1	2	2											20	
	18									1	1	13	10	15	10	22	15	27	24	20	13	3	2	1	1	4	6		18	
	16									12	9	44	40	87	67	85	70	45	61	49	45	17	14	3	3	344	28		16	
	14	4	3			6	5	7	5	48	41	43	69	46	97	44	98	39	93	45	74	32	33	12	11	326	44		14	
	12	5	6	10	7	10	12	31	27	39	67	24	85	3	99	3	100			20	87	24	51	17	22	186	55		12	
	10	16	17	19	21	28	31	37	52	32	88	16	95						17	97	20	65	22	36	217	67		10		
	8	24	33	14	31	26	48	18	64	7	93	4	98						3	99	19	78	25	52	140	75		8		
	6	23	49	12	39	21	63	21	78	7	97								1	100	17	89	23	67	128	82		6		
	4	26	66	21	54	18	75	15	88	2	99										11	97	28	84	121	89		4		
	2	24	82	34	79	18	87	7	93												5	100	15	95	103	95		2		
	0	19	95	19	92	11	95	6	97	2	100															64	98		0	
	-2	7	100	10	99	8	100	4	100																	29	100		-2	
	-4			1	100																					1	100		-4	
	-6																												-6	
10,000	12									3	2	4	3	2	1	1	7	6		7	5					24	1		12	
	10									4	6	26	20	19	14	38	25	43	42	21	18	7	5	2	1	162	11		10	
	8									38	31	56	57	78	64	82	78	54	87	72	65	31	26	3	3	419	34		8	
	6	7	5	3	2	3	3	29	22	36	55	45	87	51	97	33	99	13	98	39	90	41	53	21	17	321	52		6	
	4	14	14	8	8	35	26	30	42	46	85	11	95	4	100				12	97	31	74	31	38	225	65		4		
	2	24	31	29	25	39	53	33	64	15	95															25	55		2	
	0	30	51	26	47	30	73	27	82	5	99															13	94		0	
	-2	17	63	20	61	20	87	15	92	2	100															5	97		-2	
	-4	14	72	18	73	6	91	7	97																	13	94		-4	
	-6	20	86	16	85	7	95	2	98																	11	97		-6	
	-8	13	95	11	92	5	99	3	100																	4	99		-8	
	-10	4	97	9	99	2	100																			1	100		-10	
	-12	2	99	2	100																						4	100		-12
	-14	2	100																								2	100		-14
18,000	-2									1	1															1	1			-2
	-4									3	3																			-4
	-6	1	1							15	13	47	40	48	34	52	39	53	56	30	25	9	8	4	5	262	18		-6	
	-8	4	4	1	1	1	1	13	10	50	48	50	74	66	78	57	77	43	93	44	67	45	38	12	13	406	41		-8	
	-10	3	6	7	6	4	4	25	26	34	71	27	93	26																

TABLE I. - SUMMARY OF RADIOSONDE MEASUREMENTS OF UPPER-AIR TEMPERATURES - Continued

[illegible]

TABLE I.- SUMMARY OF RADIOSONDE MEASUREMENTS OF UPPER-AIR TEMPERATURES - Continued

Alt., ft	t, °C	Jan.		Feb.		March		April		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.		Total		t, °C		
		f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %			
(1) International Falls, Minn.																														
5,000	22							1	1			1	1	6	4	2	1	2	1							4		22		
	20							3	3			6	5	21	18	9	7	4	4	1	1					22	2	20		
	18									2	1	6	5	16	14	5	10	1	5	2	2					40	4	18		
	16									7	6	17	16	17	29	15	20	9	11	2	3					47	7	16		
	14									9	12	16	27	25	45	25	34	4	15	7	8					88	12	14		
	12							5	4	12	20	21	41	35	68	22	50	8	21	5	11	1	1			109	18	12		
	10	1	1					7	11	15	30	28	60	25	85	33	72	14	30	9	17	2	2			134	26	10		
	8							6	15	10	36	23	75	8	90	28	90	14	40	13	25	1	3	1	1	104	32	8		
	6					3	2	7	19	16	47	16	86	7	95	13	98	20	54	21	39	9	9			112	38	6		
	4							13	28	23	62	8	91	6	99	3	100	21	88	10	46	5	13	1	1	94	43	4		
	2	1	1	7	8	5	5	14	37	12	70	9	97			15	77	14	55	9	19	5	5			89	48	2		
	0	2	5	5	12	3	7	13	46	13	79	2	99			17	89	9	60	8	25	7	9			79	53	0		
	-2	5	6	4	15	4	10	14	55	16	89	1	99			10	94	14	70	12	34	8	14			88	58	-2		
	-4	9	12	6	19	14	19	15	65	7	94	1	100	2	100			3	98	13	79	12	42	10	21	94	63	-4		
	-6	12	20	7	24	7	23	22	80	4	97					3	100	10	86	13	51	18	33	96	68			-6		
	-8	16	30	19	39	17	34	11	87	1	97							11	93	17	64	15	42	107	74			-8		
	-10	12	38	14	49	23	49	2	89	2	99							4	96	11	71	20	55	88	79			-10		
	-12	17	49	17	62	21	63	8	94	2	100							4	98	15	82	20	68	104	85			-12		
	-14	22	63	18	75	16	73	4	97									2		7	87	12	76	81	89			-14		
	-16	13	72	9	82	10	80	3	99									1	100	7	92	9	82	52	92			-16		
	-18	6	76	6	86	12	88													4	95	4	84	32	94			-18		
	-20	11	83	6	90	9	94													3	97	7	89	36	96			-20		
	-22	9	89	3	93	6	97													3	99	6	93	27	98			-22		
	-24	7	94	5	96	2	99	2	100											1	100	5	96	22	99			-24		
	-26	5	97	3	99																		3	98	11	99			-26	
	-28	3	99			2	100																2	99	7	100			-28	
	-30	1	99	1	99																		1	100	3	100			-30	
	-32			1	100																			1	100	1	100			-32
	-34	1	100																						1	100	1	100		
10,000	14															1	1									1		14		
	12															1	1									5		12		
	10											3	2	6	7	5	5	4	3							18	1	10		
	8											3	4	25	23	13	13	6	7	2	1					49	4	8		
	6											6	5	34	45	28	31	8	13	2	3					91	9	6		
	4							3	2			17	16	30	65	32	52	12	21	3	6					116	14	4		
	2									13	14	21	49	19	78	28	70	11	29	17	17					111	22	2		
	0							11	9	27	32	21	63	13	86	25	86	23	45	22	31	3	4			146	30	0		
	-2	1	1	2	1			12	17	20	45	25	80	8	91	15	96	21	99	17	42	5	7	1	1	128	37	-2		
	-4	1	1	3	4	5	3	20	31	28	58	20	94	10	98	5	99	21	74	16	53	12	15	4	6	139	45	-4		
	-6	3	5	8	9	9	9	22	46	19	71	6	98	3	100	1	100	13	83	12	60	13	25	10	12	119	52	-6		
	-8	6	7	8	15	7	14	8	51	14	80	2	99					10	90	14	70	16	36	12	20	97	57	-8		
	-10	14	16	12	24	13	22	18	63	10	87	1	100					11	98	17	81	13	45	15	30	124	64	-10		
	-12	16	27	9	30	13	30	17	75	12	95							1	99	7	85	21	59	15	40	111	70	-12		
	-14	17	38	19	44	17	41	7	79	3	97							2	100	8	90	18	72	22	54	113	76	-14		
	-16	22	52	19	58	28	59	15	88	4	99									5	94	11	80	13	63	115	83	-16		
	-18	18	44	22	73	18	71	12	96	1	100									6	97	10	87	16	73	103	89	-18		
	-20	18	76	10	81	19	83	3	98											3	99	7	92	9	79	69	92	-20		
	-22	11	83	10	88	4	86													4	94	12	87	41	95			-22		
	-24	12	91	8	94	9	92	1	99											1	100	3	97	5	90	39	97	-24		
	-26	5	94	5	97	6	96	1	99											2	98	11	97	30	98			-26		
	-28	7	99	3	99	4	98													1	99	1	98	16	99			-28		
	-30	1	99	1	100	3	100	1	100											1	99				7	100			-30	
	-32																			1	100	2	99	3	100					-32
	-34	1	100																			1	100	2	100					-34
18,000	-4													1	1											1		-4		
	-6													7	5	3	2									10	1	-6		
	-8													11	13	8	7									25	2	-8		
	-10									1	1	12	12	35	37	26	25	8	6							82	7	-10		
	-12									5	4	27	31	42	65	37	50	17	18							131	14	-12		
	-14							2	1	15	14	30	52	21	79	29	69	16	29	11	9					124	21	-14		
	-16							8	7	24	30	25	69	12	87	26	87	32	51	24	25	4	3			155	30	-16		
	-18							14	16	27	48	21	83	10	94	13	95	24	68	24	41	9	9	5	3	148	38	-18		
	-20	1	1	5	4	3	3	16	27	15	58	14	93	5	97	6	99	22	84	28	60	11	17	5	5	129	46	-20		
	-22	3	3	10	11	6	7	28	45	17	70	7	98	4	100	1	100	9	90	18	72	20	31	12	13	155	53	-22		
	-24	13	11	8	17	19	19	15	55	21	84	2	99					6	94	14	81	18	44	15	23	131	61	-24		
	-26	14	21	13</																										

TABLE I. - SUMMARY OF RADIOSONDE MEASUREMENTS OF UPPER-AIR TEMPERATURES - Continued

Alt., ft	t, °C	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	t, °C
		f cpd %	f cpd %	f cpd %	f cpd %	f cpd %	f cpd %	f cpd %	f cpd %	f cpd %	f cpd %	f cpd %	f cpd %	f cpd %	
(f) International Falls, Minn. - Continued															
30,000	-32						5 4	4 3	13 9	2 1				4	-32
	-34						6 8	13 12	2 3					33 2	-34
	-36						17 20	23 28	15 19	2 4				46 5	-36
	-38					1 1	26 58	29 48	18 32	7 9	1 1	1 1		74 9	-38
	-40	1 1	1 1		1 1	11 8	27 40	32 70	30 52	16 21	1 1	1 2		120 16	-40
	-42	1 1	3 3		2 2	12 16	30 55	34 76	21 36	17 13	1 2	1 2		137 24	-42
	-44	3 4	2 5	3 2	9 8	28 35	31 81	10 92	23 92	34 60	35 37	4 5	6 4	184 35	-44
	-46	14 13	8 10	8 7	30 40	34 78	12 96	4 99	1 99	20 95	31 80	29 39	14 14	205 56	-46
	-48	18 26	20 25	32 28	27 58	13 87	5 99	1 100	1 100	4 98	13 88	26 59	22 29	182 67	-48
	-50	26 44	25 44	41 55	29 78	16 98				8 94	31 82	27 48	206 79		-50
	-52	36 70	31 67	38 80	15 88	3 100	1 100			5 97	14 95	42 74	185 89		-52
	-54	25 87	35 93	17 91	13 97					3 99	7 98	21 91	121 96		-54
	-56	15 98	6 98	9 97	1 97					1 100	2 99	9 97	43 99		-56
	-58	1 99	3 100	3 99	3 99						1 100	4 99	13 100		-58
	-60	2 100	1 100	1 100	1 100							1 100	5 100		-60
	-62														-62
38,500	-40						1 1		2 1		2 2	1 1	1 1	1	-40
	-42				1 1		4 4	2 1	5 4	1 1	2 2	1 2	1 2	27 2	-42
	-44	3 2	4 3	1 1	1 2	5 4	5 7	4 4	2 3	5 7	4 4	2 4	7 7	61 6	-44
	-46	10 10	8 9	7 6	1 2	6 8	9 14	9 10	9 9	9 14	7 9	6 9	12 15	129 14	-46
	-48	20 26	11 18	11 13	15 12	11 15	9 17	18 23	18 22	15 25	14 18	18 23	13 25	199 26	-48
	-50	21 42	17 31	28 33	13 22	13 24	11 22	18 23	17 33	18 38	14 28	19 38	18 38	222 39	-50
	-52	20 57	16 43	30 54	16 34	15 35	16 34	23 39	17 33	18 38	14 28	19 38	18 38	242 54	-52
	-54	15 69	17 56	11 62	16 45	13 44	10 42	33 62	41 62	24 55	23 44	17 51	22 54	234 68	-54
	-56	11 78	19 71	17 74	12 54	13 55	28 62	25 79	31 83	21 70	17 56	19 66	21 69	274 79	-56
	-58	13 88	10 79	11 82	10 61	14 63	19 76	20 93	12 92	20 85	19 70	13 76	13 79	174 89	-58
	-60	7 93	11 87	18 94	12 70	13 72	22 93	8 99	8 97	9 91	20 84	11 85	11 87	150 88	-60
	-62	3 95	5 91	3 97	16 82	24 85	5 99	2 100	4 100	10 99	8 99	7 91	7 92	97 94	-62
	-64	4 98	4 95	3 99	15 93	9 94	2 100			2 100	10 97	7 96	1 94	61 97	-64
	-66	1 99	2 100	1 100	2 100	2 100					1 100	1 99	3 98	34 99	-66
	-68	1 100										1 100	1 99	10 100	-68
	-70												2 100	2 100	-70
53,000	-48		3 3	1 1	4 4	1 1					1 1	2 2	2 4		-48
	-50	4 4	3 9	9 8	6 9	1 2				3 3	1 2	3 4	1 15	14 1	-50
	-52	20 25	13 22	24 28	14 21	11 11	13 11	5 4	6 5	9 10	4 5	11 14	14 24	144 15	-52
	-54	24 50	12 35	27 51	20 39	29 35	18 27	15 16	17 18	16 23	10 13	21 34	30 51	239 32	-54
	-56	28 68	22 57	25 72	24 60	23 55	21 45	23 33	23 37	27 46	20 29	23 56	20 48	269 51	-56
	-58	17 86	19 77	24 92	25 82	29 79	34 75	24 52	24 56	26 67	28 51	17 72	21 83	288 72	-58
	-60	13 99	15 92	6 97	16 97	18 94	15 88	29 74	26 76	21 84	28 74	13 85	11 94	211 87	-60
	-62		5 97	4 100	4 100	3 97	10 97	22 92	22 94	13 95	18 88	13 97	2 96	116 96	-62
	-64	1 100	1 100			4 100	3 99	11 100	7 99	5 99	11 97	3 100	3 98	49 99	-64
	-66						1 100		1 100	1 100	4 100	1 100	1 99	10 100	-66
	-72												1 100	1 100	-72
67,500	-48		3 6			1 1	1 1	2 2				2 3	9 1		-48
	-50		2 10			1 3	5 7	9 10	9 10	4 9	1 1	4 8	25 4		-50
	-52	1 3	5 20		5 8	5 8	9 14	31 40	29 40	4 9	1 2	6 16	97 15		-52
	-54	2 8	8 36	17 22	18 34	27 44	33 56	32 74	30 72	16 30	5 8	1 4	13 33	202 38	-54
	-56	7 26	2 40	21 49	22 67	25 77	33 98	21 96	21 94	26 64	16 27	12 25	18 57	224 64	-56
	-58	14 62	6 32	25 79	13 87	11 92	2 100	4 100	6 100	22 92	25 57	23 65	14 75	163 83	-58
	-60	10 87	10 72	12 95	7 97	4 97				6 100	28 89	10 83	9 87	94 94	-60
	-62	4 97	8 88	4 100	2 100	2 100					9 100	8 97	7 96	44 99	-62
	-64		3 94									2 99	7 99	7 99	-64
	-66	1 100	3 100									2 100	1 100	5 100	-66
78,500	-44					2 4	1 2							3 1	-44
	-46				1 2	4 12	4 9	1 2						10 3	-46
	-48				1 5	6 25	21 43	18 31	2 4	1 3	1 5			50 16	-48
	-50				5 16	14 53	21 81	24 69	5 14	1 7			1 4	72 34	-50
	-52	1 6		2 11	13 47	19 92	11 100	15 94	19 52	6 27			3 17	89 57	-52
	-54	1 12	3 30	6 42	6 50	14 79	4 100	10 72	10 72				4 35	52 70	-54
	-56	4 35	4 63	4 63	3 71	6 93		12 96	6 47	2 16	6 41	43 81			-56
	-58	6 71	2 50	4 84	4 100	2 98		2 100	10 80	6 47	3 74	39 91			-58
	-60	5 100	1 60	2 95		1 100			6 100	4 68	4 91	23 97			-60
	-62		2 80	1 100							4 90	7 99			-62
	-64		2 100								1 95	5 100			-64
	-66										1 100	1 100			-66
87,000	-40					1 4								1 1	-40
	-42					1 8								1 1	-42
	-44				1 13	3 20	8 29	3 13						15 12	-44
	-46					5 40	9 61	5 33	1 5		1 20			21 27	-46
	-48				3 30	7 68	8 89	13 88	3 20	1 8				35 53	-48
	-50				1 63	5 88	2 96	2 96	9 65	3 33				22 68	-50
	-52				1 75	2 96	1 100	1 100	4 85				2 67	11 76	-52
	-54		2 67	3 75	1 88	1 100			3 100		2 50			12 85	-54
	-56	3 80									3 75	1 40		5 89	-56
	-58	2 100	2 100		1 100						2 92	1 80	1 100	8 94	-58
	-60										1 100	1 80		8 99	-60
	-62			1 100								2 100		2 100	-62

TABLE I. - SUMMARY OF RADIOSONDE MEASUREMENTS OF UPPER-AIR TEMPERATURES - Continued

Alt., ft	t, °C	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	t, °C
		f cpd %	f cpd %	f cpd %	f cpd %	f cpd %	f cpd %	f cpd %	f cpd %	f cpd %	f cpd %	f cpd %	f cpd %	f cpd %	
(f) International Falls, Minn. - Concluded															
102,000	-44 -46 -48 -50 -56							1 33 1 67			2 100		1 100	1 13 1 25 2 50 3 88 1 100	-44 -46 -48 -50 -56
(g) El Paso, Texas															
5,000	36 34 32 30 28 26 24 22 20 18 16 14 12 10 8 6 4 2 0 -2 -4 -6 -8 -10						1 1 1 1 4 4 11 11 25 28 30 47 24 63 15 73 27 62 18 84 4 88 3 100	1 1 17 15 29 35 31 83 40 62 29 70 14 92 4 95 5 98 2 99 2 100	1 1 8 6 28 24 42 51 29 70 23 84 17 96 5 99 1 99 3 100	1 1 8 6 30 26 41 54 34 77 18 89 26 59 5 98 3 100	5 3 24 19 36 42 26 59 5 3 4 3 5 3 4 99 1 100	34 54 12 18 22 33 11 10 137 71 125 78 110 84 75 89 65 92 19 86 48 98 5 99 3 99 4 100 1 100	1 13 1 25 2 50 3 88 1 100	36 34 32 30 28 26 24 22 20 18 16 14 12 10 8 6 4 2 0 -2 -4 -6 -8 -10	
10,000	20 18 16 14 12 10 8 6 4 2 0 -2 -4 -6 -8 -10 -12 -14 -16						1 1 6 5 25 21 42 49 22 20 41 77 25 93 41 63 7 98 2 99 1 100	4 3 14 12 47 42 36 29 53 50 22 94 8 99 1 100	9 6 18 15 36 29 53 50 38 96 6 100	4 3 18 15 36 29 53 84 14 95 7 100	4 3 30 26 49 59 25 75 14 85 8 90 10 97 3 99 1 99 1 100	14 12 22 26 24 41 37 65 14 74 20 87 7 92 21 98 5 97 10 100 4 100 2 100	1 13 1 25 2 50 3 88 1 100	20 18 16 14 12 10 8 6 4 2 0 -2 -4 -6 -8 -10 -12 -14 -16	
18,000	-2 -4 -6 -8 -10 -12 -14 -16 -18 -20 -22 -24 -26 -28 -30 -32 -36						1 1 8 6 23 21 31 41 15 95 7 100	5 3 50 37 78 89 17 100	3 2 55 38 74 86 20 99 1 100	4 3 29 22 65 67 33 89 13 98 3 100	6 4 22 18 44 47 39 41 48 78 29 97 2 98 3 100	2 1 21 15 25 21 24 37 29 56 5 91 6 95 5 98 2 99 1 100	1 13 1 25 2 50 3 88 1 100	-2 -4 -6 -8 -10 -12 -14 -16 -18 -20 -22 -24 -26 -28 -30 -32 -36	
30,000	-30 -32 -34 -36 -38 -40 -42 -44 -46 -48 -50 -52						8 6 36 32 27 19 33 81 19 94 47 82 19 94 7 99 4 97 5 100	6 4 50 88 16 99 33 81 19 94 8 100	11 8 60 89 15 99 44 87 12 95 6 99 1 100	3 2 27 21 50 56 44 87 32 45 48 76 28 95 6 99 2 100	14 11 19 24 32 45 48 76 37 74 28 93 9 99 1 100	10 7 13 11 15 11 21 25 29 44 36 68 26 85 14 94 8 99 1 100	1 13 1 25 2 50 3 88 1 100	-30 -32 -34 -36 -38 -40 -42 -44 -46 -48 -50 -52	

TABLE I.- SUMMARY OF RADIOSONDE MEASUREMENTS OF UPPER-AIR TEMPERATURES - Continued

Alt., ft	t, °C	Jan.		Feb.		March		April		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.		Total		t, °C		
		f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %			
(g) El Paso, Texas - Concluded																														
38,500	-42					1	1	1	1	1	1													1	1	1	-42			
	-46					1	2	3	3	1	1												2	2	14	1	-46			
	-50	6	5	3	2	8	8	6	8									2	1	1	1	1	4	5	42	4	-50			
	-52	11	19	14	22	7	13	3	10	9	7	3	2	11	8	16	12	20	16	6	5	5	4	10	12	115	11	-52		
	-54	14	29	13	32	11	22	5	13	7	12	21	17	66	54	69	61	66	64	26	22	15	15	17	23	330	30	-54		
	-56	15	40	16	45	18	36	12	22	20	26	60	61	57	94	43	92	38	91	50	56	20	30	19	36	368	53	-56		
	-58	14	51	16	57	11	44	19	37	42	54	43	92	9	100	11	100	9	98	33	78	42	60	26	54	275	69	-58		
	-60	20	66	18	71	20	60	23	54	37	79	8	98					3	100	24	95	32	83	22	69	207	81	-60		
	-62	25	84	14	82	22	77	32	78	25	93	2	99							8	100	14	94	29	88	171	92	-62		
	-64	9	91	12	91	23	95	21	93	6	99											15	99			66	97	-64		
	-66	10	99	10	99	5	98	9	100	1	100											9	100			37	100	-66		
	-68	2	100	2	100	2	100																	2	100	6	100	-68		
53,000	-56			2	2					2	2														2		-56			
	-58	1	1	3	5	1	1	2	2									1	1			2	2			10	1	-58		
	-60	1	2	7	12	2	3	6	6															4	3	22	3	-60		
	-62	6	8	12	24	8	12	12	13	16	18									1	1	2	3	11	12	68	7	-62		
	-64	6	14	14	38	14	27	24	36	25	37	3	3	1	1					2	2	4	7	12	22	105	15	-64		
	-66	13	27	18	55	20	48	29	63	27	58	12	12	1	2					7	8	20	23	19	38	167	27	-66		
	-68	17	43	17	72	24	73	20	82	15	69	18	27	13	13	4	3			5	6	10	15	23	43	27	40	193	41	-68
	-70	31	74	10	82	15	89	14	95	24	87	24	47	22	32	35	33	24	25	37	44	20	59	22	78	278	61	-70		
	-72	13	86	13	95	9	99	4	90	31	72	36	64	44	70	27	47	34	70	30	84	16	91	262	80	72	80	-72		
	-74	9	95	4	99	1	100	9	97	26	93	24	84	30	95	44	83	21	86	10	93	5	95	183	93	71	98	-74		
	-76	2	97	1	100			4	100	7	99	12	95	6	100	16	96	11	95	7	98	5	99	71	98	71	98	-76		
	-78	3	100									5	99											23	100	23	100	-78		
	-80									1	100	1	100					5	100	7	100	2	100	1	100	2	100	-80		
67,500	-50									1	1			1	1											1	-50			
	-54			1	2					1	1															3	-54			
	-56			1	4	2	4	2	3	14	16	8	10	9	13	8	9	4	4	3	3	1	1	2	2	54	4	-56		
	-58	1	3	4	12	9	23	5	10	22	40	39	59	35	55	43	55	34	39	17	20			4	7	213	29	-58		
	-60	3	10	8	28	5	33	25	46	30	73	26	91	30	91	32	90	47	87	32	51	16	19	11	20	265	58	-60		
	-62	2	15	8	44	9	52	18	71	19	94	7	100	7	99	9	100	12	99	26	77	25	46	20	44	162	75	-62		
	-64	14	50	9	62	11	75	14	91	5	99			1	100			1	100	21	97	24	73	29	78	129	89	-64		
	-66	10	75	10	82	4	85	5	99	1	100									3	100	22	97	16	97	71	96	-66		
	-68	6	90	5	92	4	92	1	100													2	99	3	100	21	99	-68		
	-70	1	95	1	94	2	96															1	100			5	99	-70		
	-72	3	100	3	100					1	98													7	100	7	100	-72		
	-74					1	100																	1	100	1	100	-74		
78,500	-46									1	2	1	3	3	6											1	-46			
	-48									6	14	7	22	10	25			5	7	1	1	1	2			39	9	-48		
	-50			1	7	1	6	4	17	21	54	13	58	25	72	23	63	21	38	11	17	5	11			124	34	-50		
	-52			1	13			8	39	8	50	16	85	14	97	10	91	16	96	35	88	23	50	9	27	15	42	83	-52	
	-54							10	92	5	94	1	100	5	100			7	99	24	84	13	50	8	42	83	81	-54		
	-56	1	9	2	27	5	67	6	100	2	100							1	100	10	99	17	80	6	58	52	92	-56		
	-58	1	16	6	67																								-58	
	-60	4	55	4	93															1	100	6	91	10	86	25	97	-60		
	-62	5	100	1	100																	3	96	4	97	13	99	-62		
	-64																					2	100	1	100	3	100	-64		
87,000	-44									2	13	1	6			1	5									4	3	-44		
	-46							1	13	2	25	4	31	2	18							1	8			10	9	-46		
	-48							2	38	3	44	7	75	6	73	4	25	6	27	2	8					30	29	-48		
	-50					1	17	1	50	5	75	4	100	2	91	10	75	10	73	5	28	1	15	1	11	40	55	-50		
	-52					2	50	2	75	4	100			1	100	5	100	5	96	10	68	1	23	2	33	32	74	-52		
	-54					2	83	2	100													5	62	2	56	18	88	-54		
	-56	1	100	2	33	1	100															4	92	3	89	12	95	-56		
	-58			2	67															1	100			1	100	4	98	-58		
	-60			2	100																			1	100	3	100	-60		
102,000	-44									1	100															1	20	-44		
	-46											1	100													1	40	-46		
	-48													1	100											1	40	-48		
	-54																			1	100				1	100	-54			

TABLE I. - SUMMARY OF RADIOSONDE MEASUREMENTS OF UPPER-AIR TEMPERATURES - Continued

Alt., ft	t, °C	Jan.		Feb.		March		April		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.		Total		t, °C				
		f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %					
(h) Itazuki (Fukuoka), Japan																																
5,000	22													2	1	6	4									8	1	22				
	20													15	11	43	33	1	1							59	4	20				
	18													69	56	63	75	22	16							159	13	18				
	16													43	33	44	85	30	95	35	41	5	3			164	22	16				
	14													14	94	6	99	39	68	9	9					129	29	14				
	12													8	99	1	100	25	86	23	25	3	3			145	38	12				
	10			1	1			10	10	42	45	32	81					14	96	26	42	9	9			128	45	10				
	8			1	2			10	10	17	21	38	70	19	94			4	99	31	63	21	24	5	4	127	52	8				
	6	2	1	8	10	11	13	23	37	25	86	8	99	1	100			1	99	28	81	32	46	12	12	139	60	6				
	4	3	3	7	15	24	29	20	70	5	99							1	100	17	93	25	63	12	20	114	66	4				
	2	8	9	15	27	22	44	15	80	2	100									7	97	20	77	15	30	104	72	2				
	0	12	16	13	36	15	54	17	92											3	99	11	85	20	43	91	77	0				
	-2	25	33	14	46	21	68	7	97											1	100	10	92	31	64	109	85	-2				
	-4	18	45	15	57	17	79	5	100																		79	88	-4			
	-6	26	62	15	68	17	91																				86	93	-6			
	-8	23	77	19	82	9	97																				8	96	-8			
-10	20	90	13	92	3	99																				6	100	-10				
-12	8	95	6	96	1	99																				15	99	-12				
-14	6	99	5	100	1	100																				12	100	-14				
-16	1	100																								1	100	-16				
10,000	14													2	1	8	5	1	1							11	1	14				
	12													11	9	38	31	10	8							61	4	12				
	10									1	1	11	9	63	50	59	71	28	28	1	1					163	13	10				
	8									5	4	40	37	55	86	37	95	43	58	7	5	1	1			188	24	8				
	6									30	24	39	63	17	97	7	100	36	84	29	25	3	3			166	33	6				
	4									40	50	26	81					19	97	21	38	13	12			142	41	4				
	2									34	72	18	94					3	99	33	60	18	24	3	2	140	49	2				
	0									17	84	6	98					1	100	29	80	20	38	6	6	131	57	0				
	-2	5	3	15	20	24	31	23	64	17	95	3	100							24	95	33	61	20	19	164	66	-2				
	-4	8	9	16	31	28	50	22	78	2	98									6	99	24	78	25	34	131	75	-4				
	-6	22	23	8	37	21	64	12	87	5	99																113	80	-6			
	-8	19	36	21	53	20	77	9	93	1	100																6	92	-8			
	-10	25	52	19	66	11	84	6	97																		4	95	-10			
	-12	18	64	17	79	9	90	4	99																		2	97	-12			
	-14	23	80	13	88	7	95																				4	99	-14			
	-16	15	89	4	91	3	98			1	100																1	100	-16			
-18	9	95	7	94	3	100																					2	99	-18			
-20	3	97	2	98																							8	100	-20			
-22	4	100																								1	100	-22				
-24			1	99																						4	100	-24				
-26			2	100																							2	100	-26			
18,000	0													2	1	10	8	1	1							3		0				
	-2													10	8	17	12	9	7							38	2	-2				
	-4									2	1	8	7	51	42	62	55	25	25	2	1					150	11	-4				
	-6									4	4	34	31	45	72	45	86	34	49	4	4					166	20	-6				
	-8									9	8	28	39	30	78	35	95	20	99	45	81	21	18	2	1	187	31	-8				
	-10									24	20	37	57	35	95	20	99	45	81	19	94	20	32	7	6	122	38	-10				
	-12									31	59	20	92	8	100	1	100	6	99	30	52	9	13	2	1	122	45	-12				
	-14			1	1	2	1	21	22	31	59	26	77	11	100					21	66	21	27	4	4	140	53	-14				
	-16	1	1	12	13	23	30	31	64	14	86									2	100	21	80	29	48	10	11	141	61	-16		
	-18	9	7	13	23	25	47	21	78	13	95									22	95	26	66	29	30	158	70	-18				
	-20	20	20	24	40	32	69	14	87	4	97																23	82	-20			
	-22	35	43	24	58	21	83	9	93	4	100									7	100	17	94	28	69		138	87	-22			
	-24	20	57	20	73	11	90	6	97																		5	97	-24			
	-26	30	77	19	87	8	95	4	100																		3	99	-26			
	-28	16	87	7	92	4	98																				1	100	-28			
	-30	14	97	7	97																						4	99	-30			
-32	2	98	2	99	3	100																				1	100	-32				
-34	1	99	1	99																						2	100	-34				
-36	1	99	1	100																						2	100	-36				
-38	1	100																								1	100	-38				
30,000	-22													2	1	1	1	1	1							1		-22				
	-24													1	2	11	8	11	9	5	4					5		-24				
	-26													10	9	30	29	33	33	11	12					29	2	-26				
	-28													24	27	47	61	40	62	28	33	3	3	4	3	2	1	155	16	-28		
	-30													7	5	24	27	47	61	40	62	28	33	3	3	4	3	2	1	155	16	-30
	-32	4	3	2	2			1	1	13	14	38	54	40	88	40	91	47	67	13	12	7	8					207	28	-32		
	-34	3	5	2	3			7	9	17	26	27	73	14	98	11	99	26	86	25	29	15	19	6	7		153	37	-34			
	-36	5	8	3	5			9	12	31																						

TABLE I. - SUMMARY OF RADIOSONDE MEASUREMENTS OF UPPER-AIR TEMPERATURES - Continued

[illegible]

TABLE I.- SUMMARY OF RADIOSONDE MEASUREMENTS OF UPPER-AIR TEMPERATURES - Continued

[illegible]

TABLE I.- SUMMARY OF RADIOSONDE MEASUREMENTS OF UPPER-AIR TEMPERATURES - Continued

Alt., ft	t, °C	Jan.		Feb.		March		April		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.		Total		t, °C		
		f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %	f	cpd %			
(1) Wiesbaden, Germany - Continued																														
38,500	-42									1	1	1	1	1	1	1	1							2		-42				
	-44									1	1	2	3			2	2			1	1			8	1	-44				
	-46									1	1	1	4			7	7			1	2			23	2	-46				
	-48	2	2	3	6					12	12	2	5	19	19	12	15	15	12					1	1	2	7	-48		
	-50	2	4	8	14	1	1	4	4	5	16	13	17	12	28	17	27	7	18	10	10	5	4	4	5	88	13	-50		
	-52	2	7	7	21	13	13	6	10	16	27	17	31	20	42	16	39	8	25	4	13	14	15	6	10	129	22	-52		
	-54	10	18	13	35	15	27	11	21	15	37	16	45	19	56	19	52	9	32	11	22	13	24	15	21	166	33	-54		
	-56	14	33	15	50	18	44	17	37	12	45	15	58	14	66	22	67	19	48	17	34	14	35	13	30	189	46	-56		
	-58	12	47	11	61	7	51	10	47	15	56	14	70	23	82	19	80	16	61	13	44	13	44	13	40	166	38	-58		
	-60	12	60	12	74	11	61	16	63	16	67	9	78	17	94	13	90	26	82	18	58	12	53	16	52	178	70	-60		
	-62	10	71	7	81	14	75	7	70	31	89	19	95	8	100	13	100	14	95	29	79	10	81	20	64	186	82	-62		
	-64	6	78	6	87	9	83	11	80	10	96	6	100							22	96	18	74	16	78	110	90	-64		
	-66	7	86	3	90	9	92	15	95											6	100	17	87	17	90	80	95	-66		
	-68	5	91	8	98	7	98	4	99													14	97	7	96	45	98	-68		
-70	6	98	2	100			1	100													4	99	19	100	100	100	-70			
-72	2	100																			2	100	4	100			-72			
53,000	-44														1	1									1		-44			
	-46									3	3	5	5	11	16	8	9			1	1					7	1	-46		
	-48									19	21	16	22	20	35	32	39	7	11							29	4	-48		
	-50									29	48	26	50	30	65	24	61	6	18			3	4			3	4	139	29	-50
	-52	3	8	2	5	2	4	11	17	29	48	26	50	30	65	24	61	6	18	3	4			3	4	139	29	-52		
	-54	3	22	6	25	10	24	15	37	30	76	34	85	21	85	24	83	17	38	5	11			7	12	174	47	-54		
	-56	3	31	10	50	19	62	20	63	20	94	12	98	8	93	12	94	27	68	12	28	5	4			7	20	155	63	-56
	-58	8	53	6	65	9	80	22	92	3	99	2	100	6	99	4	97	18	89	20	56	18	24	10	31	128	77	-58		
	-60	5	67	6	80	7	94	6	100					1	100	2	99	9	99	17	79	29	60	24	58	106	88	-60		
	-62	6	83	6	95					1	100									11	94	16	78	22	82	84	95	-62		
	-64	4	94	2	100	3	100													2	97	14	94	9	92	34	98	-64		
	-66	2	100																	2	100	5	100	3	96	12	100	-66		
	-68																									1	97	1	100	-68
	-70																									2	99	2	100	-70
-72																									1	100	1	100	-72	
67,500	-46									1	1					1	1								2		-46			
	-48									1	3	1	1	4	6	1	1									7	2	-48		
	-50							1	2	5	9	10	15	5	14	7	12			1	2					29	7	-50		
	-52							7	17	13	26	28	54	26	55	30	51	3	7								107	26	-52	
	-54							3	23	27	61	26	90	24	92	20	77	13	28	1	2						114	46	-54	
	-56							6	36	18	84	7	100	5	100	13	94	24	68								75	60	-56	
	-58	1	33					12	62	12	100			4	99	16	95	7	20			2	13	54	69	58		-58		
	-60	1	67	1	6	13	68	10	83							1	100	3	100	11	46	10	19	5	30	55	79	-60		
	-62	1	100	7	50	4	90	7	98											20	95	5	28	6	50	50	88	-62		
	-64			4	75	2	100	1	100													11	49	3	60	21	92	-64		
	-66			5	94															2	100	15	77	7	85	27	97	-66		
	-68			1	100																	8	93	3	95	12	99	-68		
	-70																					3	98	2	100	5	100	-70		
	-72																					1	100	1	100	1	100	-72		
78,500	-44									1	2	1	2	1	2	1	2								4	1	-44			
	-46									1	3	1	3	10	18	6	14	1	4							19	6	-46		
	-48									3	8	6	28	14	41	11	23									34	15	-48		
	-50									10	24	22	65	18	77	14	54										74	35	-50	
	-52							2	10	28	68	17	93	12	100	15	83										82	57	-52	
	-54							5	28	9	83	4	100	8	97	13	54										40	68	-54	
	-56							6	48	10	98					2	100										33	76	-56	
	-58							4	57	7	72	1	100													1	20	27	-58	
	-60							2	86	8	100									1	100	9	83	2	9	1	27	23	-60	
	-62	1	100	2	100															3	96	3	23	3	47	12	93	-62		
	-64																			1	100	5	46	3	67	10	96	-64		
	-66																					9	86	1	73	10	98	-66		
	-68																					2	96	2	87	4	99	-68		
	-70																									1	93	1	100	-70
-72																									1	100	2	100	-72	
87,000	-38											1	2	1	3										2	1	-38			
	-40									1	2			1	6	2	7									4	3	-40		
	-42											4	12	2	13											4	6	-42		
	-44											1	5	10	35	4	25	3	17								18	15	-44	
	-46							1	9	9	27	8	54	11	59	7	40										36	32	-46	
	-48									9	49	14	86	12	97												49	56	-48	
	-50									12	78	3	93			4	97										26	69	-50	
	-52							2	27	6	95	3	100	1	100	1	100										23	80	-52	
	-54							2	46	3	100																9	85	-54	
	-56							1	55																		9	85	-56	
	-58							2	73																		8	93	-58	
	-60							2	91																					

TABLE I. - SUMMARY OF RADIOSONDE MEASUREMENTS OF UPPER-AIR TEMPERATURES - Concluded

Alt., ft	t, °C	Jan.		Feb.		March		April		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.		Total		t, °C
		f	cpd. %	f	cpd. %	f	cpd. %	f	cpd. %	f	cpd. %	f	cpd. %	f	cpd. %	f	cpd. %	f	cpd. %	f	cpd. %	f	cpd. %	f	cpd. %	f	cpd. %	
(1) Wiesbaden, Germany - Concluded																												
102,000	-24									1	13			1	13											1	3	-24
	-34									1	25	1	20	1	25	1	20									1	6	-34
	-36											1	40	1	38	1	40									4	18	-36
	-38																									3	27	-38
	-40									1	38			3	75											4	38	-40
	-42									1	50	1	60	2	100											5	53	-42
	-44									3	88	1	80			1	60									7	74	-44
	-46							1	33	1	100					2	100									2	79	-46
	-48											1	100					1	20							2	85	-48
	-50																	2	40							2	91	-50
	-52																	2	80							1	94	-52
	-54							2	100									1	100							2	100	-54

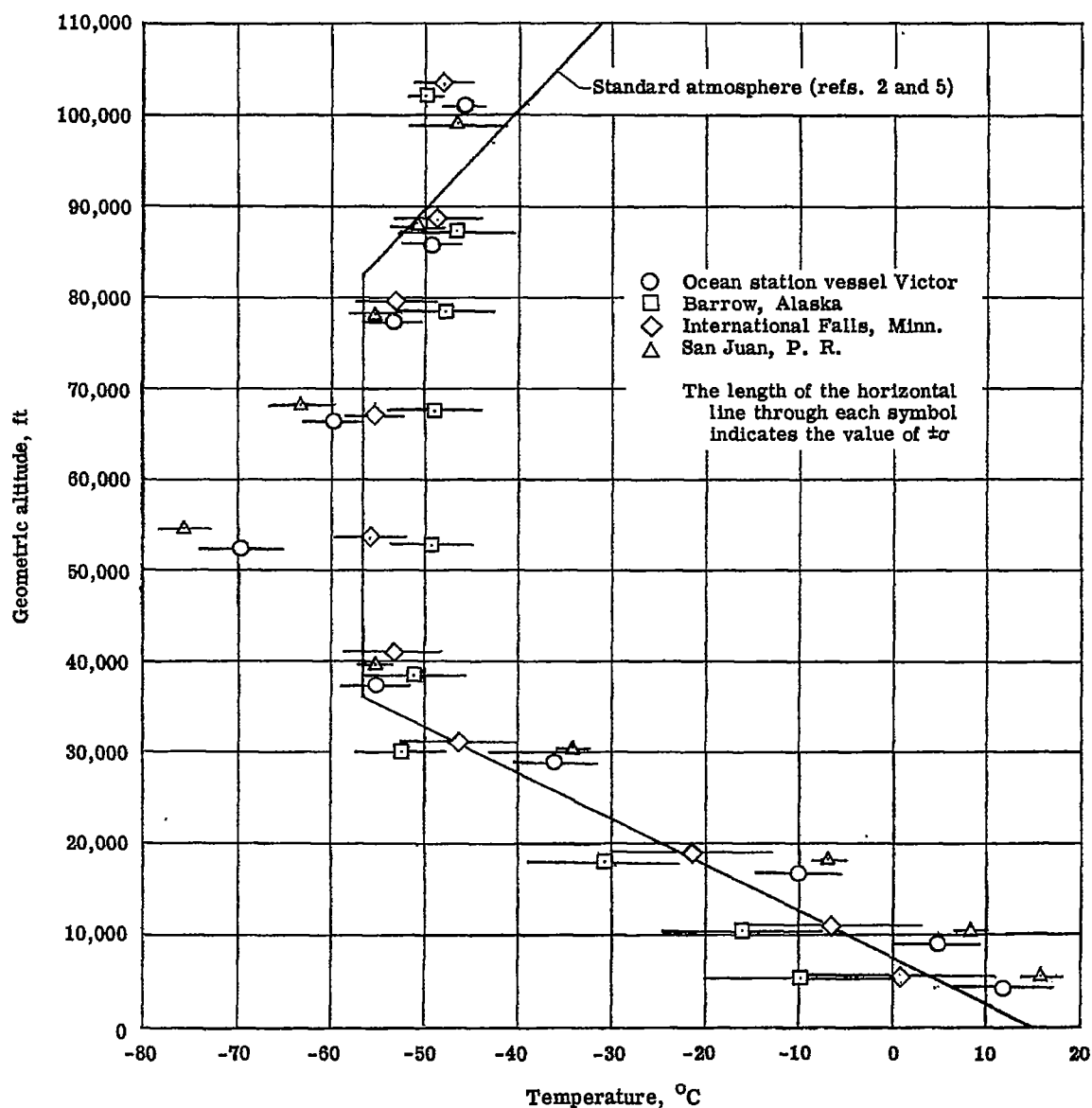


Figure 1.- Comparison of upper-air temperature measurements for several geographic locations with temperatures for standard atmosphere.